Uncertainty and Validity of Aerosol Radiative Forcing Determinations

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In February and March 1999, Ames participated in the Electro Optical Propagation around Coastal Environments (EOPACE) experiment in Duck, North Carolina, to characterize the radiative effects of boundary layer marine aerosol near the Outer Banks region of the coast of North Carolina. The NASA Ames solar spectral flux radiometer (SSFR), as shown in figure 1, was integrated on the Center for Interdisciplinary Remotely Piloted Aircraft Studies (CIRPAS) Twin Otter to measure zenith irradiance and nadir radiance (see figure 2). Data have been used to characterize the sea surface reflectance in a coastal region and to compare with open ocean reflectance for purposes of improving aerosol optical depth retrievals from the advanced very-high-resolution radiometer (AVHRR) satellite instrument. The Twin Otter was also equipped with microphysical sensors to measure the extinction of the aerosol. The study determined the net solar radiative forcing of the aerosol and examined dependencies of radiative parameters on wind speed and surface roughness. This research represents an important test of the previous discovery of a bias between measured and modeled spectral irradiance that is highly correlated with water vapor, and increases at a rate of 8 watts per square meter per centimeter ($W/m^{-2}/cm$) of water vapor (see figure 3).

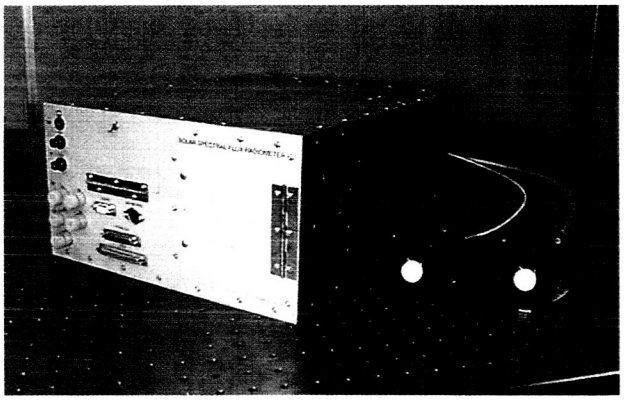

Fig. 1. Solar Spectral Flux Radiometer.

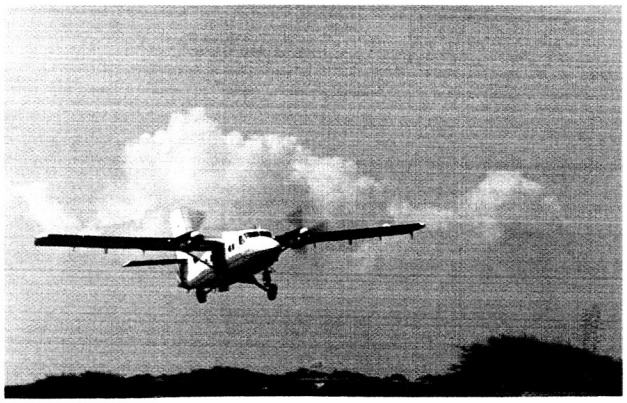

Fig. 2. DOE Twin Otter.

Another aspect of this research is to modify the radiative transfer model used in a model developed at Ames to incorporate new spectral bandpasses that match that of the SSFR. The newly generated k-distributions will be compiled using the line-by-line code LBLTRM developed by Atmospheric and Environmental Research (AER). Testing began in summer 1999, and it is anticipated that the completed radiative transfer model will be operational by the first half of FY00. Analysis will be applied to the previous aerosol/water vapor study described above and to the EOPACE Duck data set. Estimates of solar spectral radiative forcing will be generated from both studies.

Collaborators in this research include Robert Bergstrom (Bay Area Environmental Research Institute), Maura Rabbette (National Research Council Associate) and John Pommier (Symtech Corporation).

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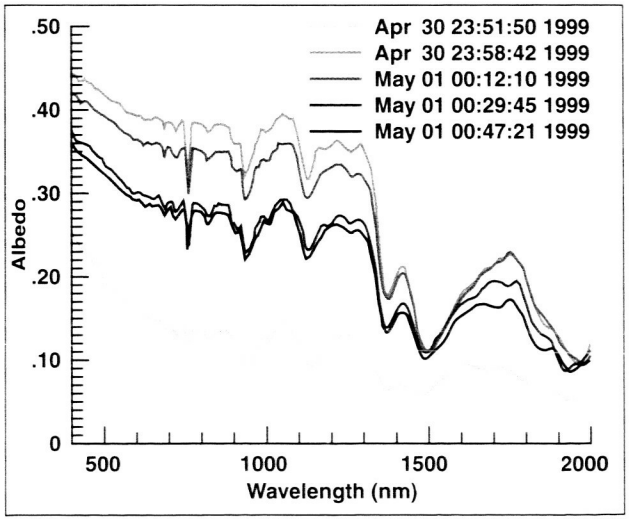

Fig. 3. Altus SSFR Spectral Albedo.